Third United Nations International Conference on the Peaceful Uses of Atomic Energy

A/CONF.28/A/202
UNITED STATES
February 1964
Original: ENGLISH

Confidential until official release during Conference

Abstract

OPERATIONAL EXPERIENCE WITH PRESSURIZED-WATER SYSTEMS

Roger J. Coe, (Yankee Atomic Electric Company)
William C. Beattie, (Consolidated Edison Company of New York)

In the six years since the 1958 Geneva Conference, three power reactors of the pressurized-water type have been placed in service in the United States. These are: (1) the Yankee Atomic Electric Company reactor at Rowe, Massachusetts; (2) the Indian Point Station of Consolidated Edison at Buchanan, New York, and; (3) the Saxton Experimental reactor at Saxton Pennsylvania. Shippingport, which was already in operation in 1958, has continued steady power production since that time.

The Yankee plant first went critical in August 1960 and began power production in November of that year. Originally licensed for 392 MW(th) and 125 MW(e), three successive power increases have been authorized so that the plant is now licensed for 600 MW(th), 185 MW(e) and has been operated at that level for extended periods during the life of Core III. Two refuelings have been completed and a third is scheduled for the summer of 1964. Cores I and II were 3.4%-enriched, stainless steel clad, batch-loaded cores. Core III was a transition core, consisting of one-half re-used Core II fuel and one-half new fuel of 4.1% enrichment. Core IV will be composed of the 4.1%-enriched fuel previously used in Core III plus a half loading of new 4.1%-enriched fuel. Gross and net electrical generation in millions of kwh for the first three fuel loadings were:

	Gross	Net
Core I	1,331	1,223
Core II	1,205	1,126
Core III (est.)	1,040	970
Total	3,576	3,319

Except for down-time due to a variety of mechanical troubles in the early months of operation, and periodic shutdowns for physics testing during the life

of Core I, the plant has exhibited a high degree of reliability. For example, during 11 months of operation on Core II, the plant use factor was 88% and reactor availability better than 95%. Power and fuel costs have been more favorable than originally expected with fuel costs running in the range of 3.0 -- 4.0 mills/KWh for the first three cores.

The Indian Point Plant, which utilizes a pressurized water reactor with oil-fired superheat, first went critical in August 1962, began power operation in September and, after a six weeks shutdown to correct deficiencies in secondary plant piping, reached full licensed power of 277 MW(e) (with oil-fired superheat) in January 1963. Since that time operation has been generally reliable with some downtime attributable to condensation problems in the control-rod-drive electrical systems, mechanical problems with primary coolant pumps, primary to secondary leakage in a steam generator and the need to line the refueling cavity and canal with stainless steel to reduce water leakage. While operation with the initial core, which contains throium as the fertile material has been generally satisfactory, the results of an economic study led to a decision to purchase a second and third core using slightly enriched uranium only.

The Saxton reactor went critical in April 1962 and produced its first power in November 1962 after an extensive low-power test program. The nominal full power level of 20 MWt was attained in January 1963. Despite it being a developmental plant, more than 20 million KWh of electricity have been generated. A comprehensive test program is under way involving experimental fuel assemblies and control rods, the use of chemical shim and operation with bulk boiling in the core.

The Shippingport plant has produced well over 1-½ x 10^9 KWh of electricity since 1957. The fourth seed of the seed-and-blanket core was installed in January 1963, and operation through the life of the fourth seed will bring the accumulated average burnup of the blanket to more than 10,000 MWd/tonne. Noteworthy in Shippingport operating history, besides the fine nuclear plant performance, is the improvement made in reducing refueling time.